

Z(ee)+Jets Analysis

- JES 5.1 jet multiplicity study
- Data vs MC: Electron horns



Samples

- **Data:**
 - EM1TRK skim
 - Single EM triggers
 - Run range: 20 April 2002 - 28 June 2004 (Runs 151,817 - 194,566)
 - Rejecting bad runs (CAL, SMT, CFT, Jet/Met, Lumi)
 - 323pb^{-1}
 - No T42 applied
 - Jetcorr v5.1
 - Processed with ATHENA (v01-05-02)
- **MC:**
 - $Z/\text{Gamma}^* \rightarrow e^+e^- + X$: 400k
Pythia
 - Processed with ATHENA (v01-05-02)

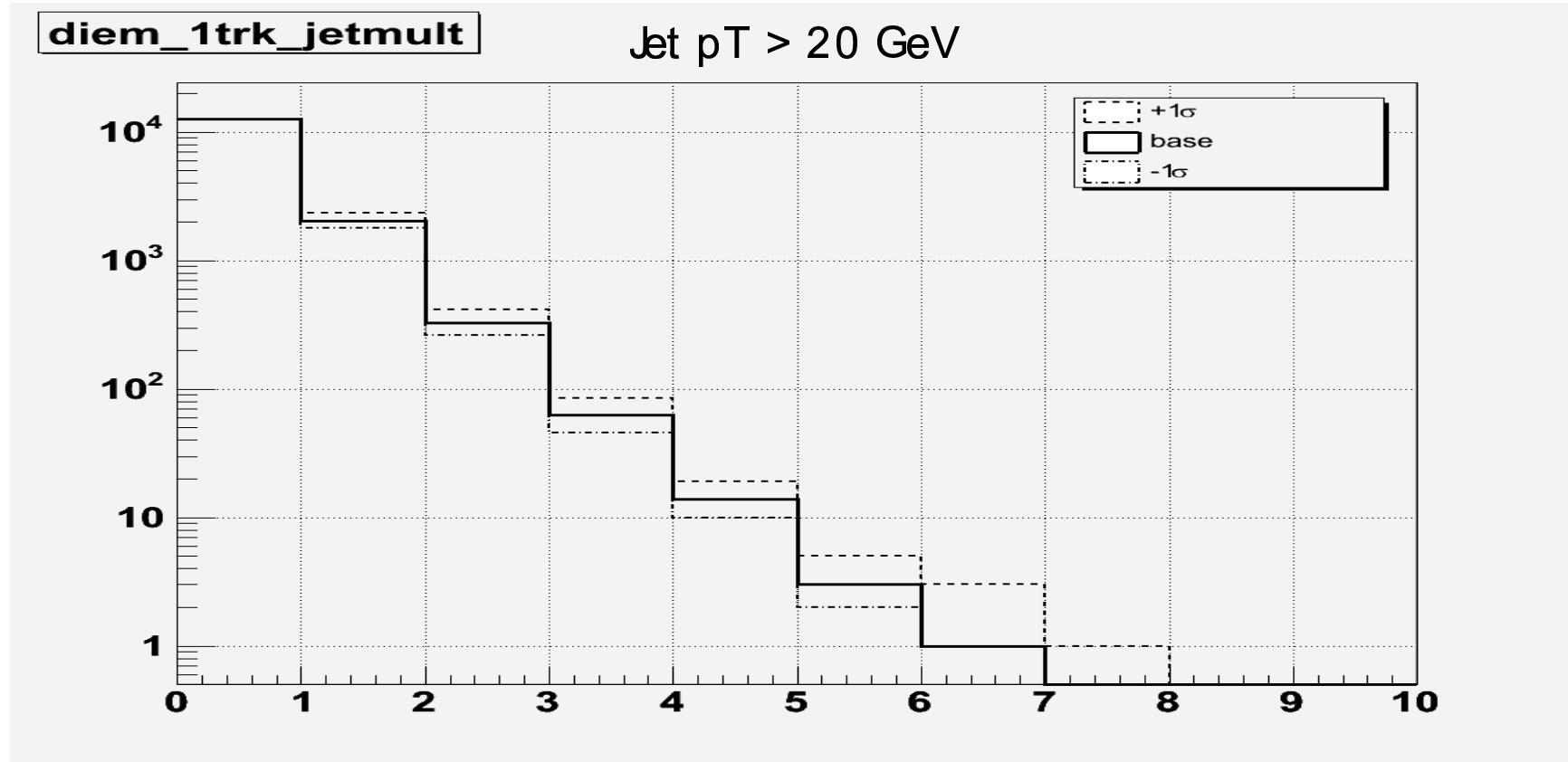


Selection Criteria

- Removing bad runs/LBNs & dupli events
- PVX cut: $|z|<60\text{cm}$
- Using unprescaled single EM triggers
- Electron selection:
 - $|\text{ID}|=10,11$
 - $\text{EMF}>0.9$
 - $\text{Iso}<0.15$
 - $\text{HMx}(7)<12$
 - $p_{\text{T}}>25\text{GeV}$
 - $|\eta|<1.1$
 - Including phi cracks
- Z selection:
 - $75\text{GeV} < M_{ee} < 105\text{GeV}$
 - At least one trackmatched electron
 - At least one electron needs to fire the trigger
- Jet selection:
 - $0.05 < \text{EMF} < 0.95$
 - $\text{HotF} < 10$
 - $N90>1$
 - $\text{CHF}<0.4$
 - L1conf
 - JES corrected $p_{\text{T}}>20\text{GeV}$
 - $|\eta|<2.5$
 - Removal of jets overlapping with electrons from Z within dR of 0.4



Effect of JES 5.1 +1sigma error variation on inclusive jet multiplicities

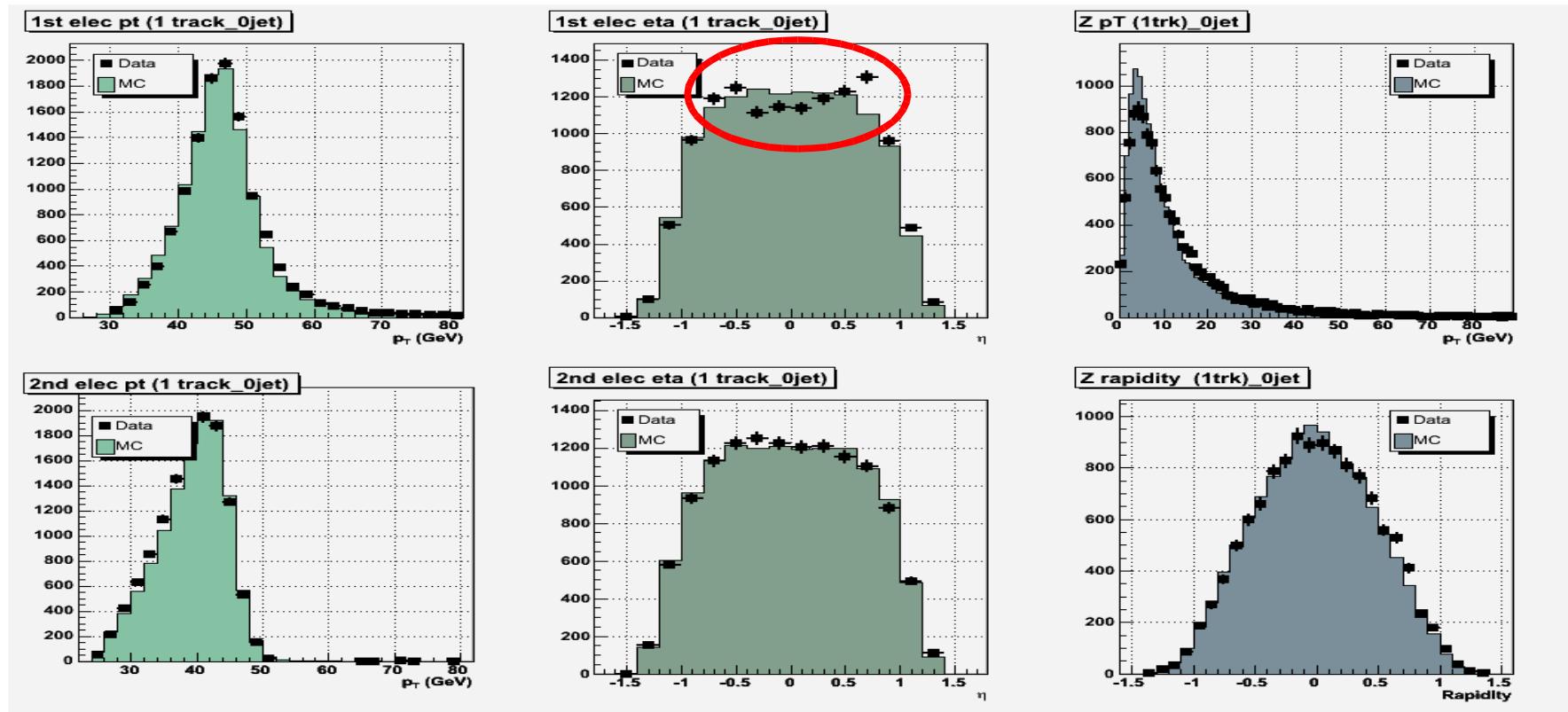


Inclusive # of jets	0	1	2	3	4	5	6	7
# events (+1sigma)	12,718	2,350 (+14%)	414 (+27%)	85 (+35%)	19 (+36%)	5 (+67%)	3	1
# events (base value)	12,718	2,032	326	63	14	3	1	0
# events (-1sigma)	12,718	1,804 (-11%)	264 (-19%)	46 (-27%)	10 (-29%)	2 (-33%)	1	0



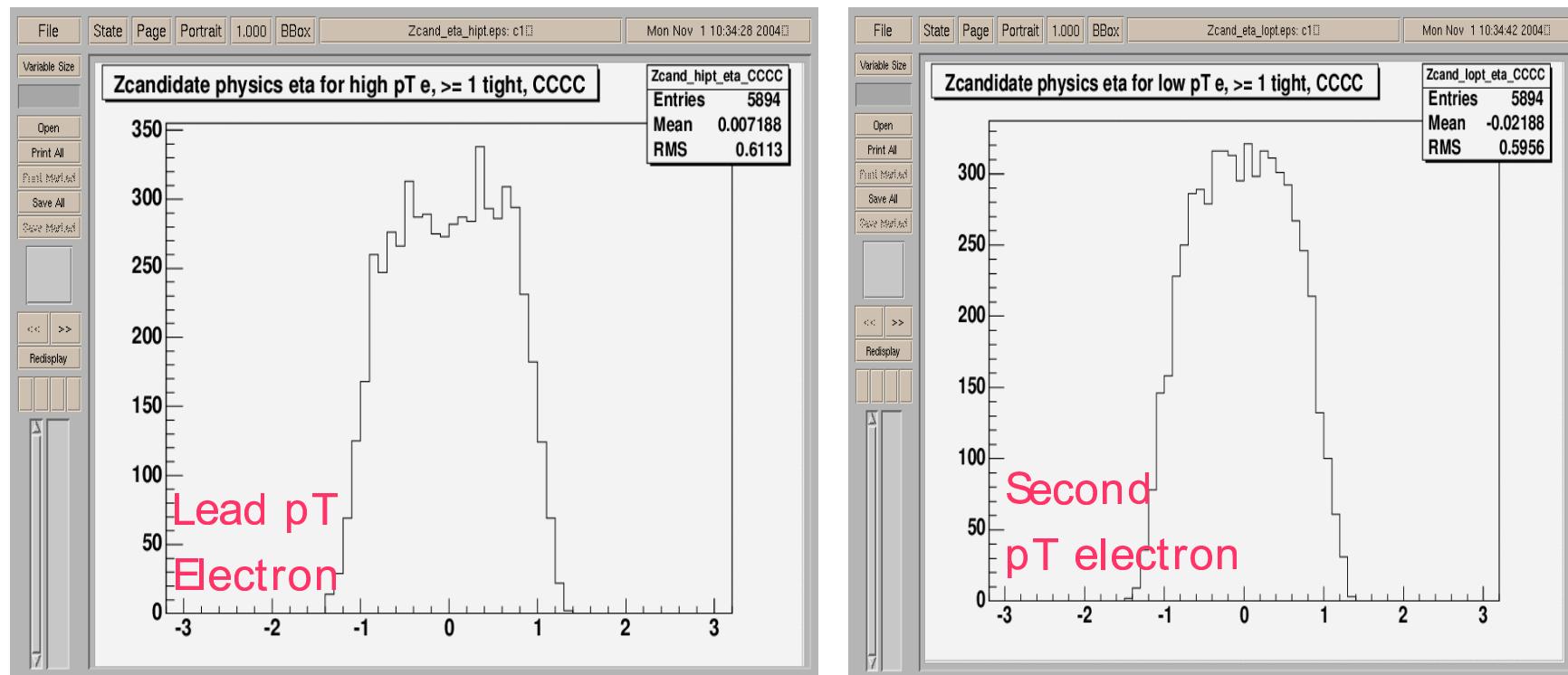
Data vs MC

- MC = Pythia sample
- MC: smearing: $pT' = pT c [1 + \text{Gauss}(0, f)]$ $c = 1.003, f = 0.045$
- Data: background subtracted based on sidebands (40-75GeV & 105-140GeV)



Comparison with Electroweak Group (John Gardner)

- same electron quality cuts
- $pT > 25 \text{ GeV}$
- CCCC electrons
- not applying bad-CAL-map (with bad-CAL-map horns are still there!)
- smaller dataset (177 pb^{-1})



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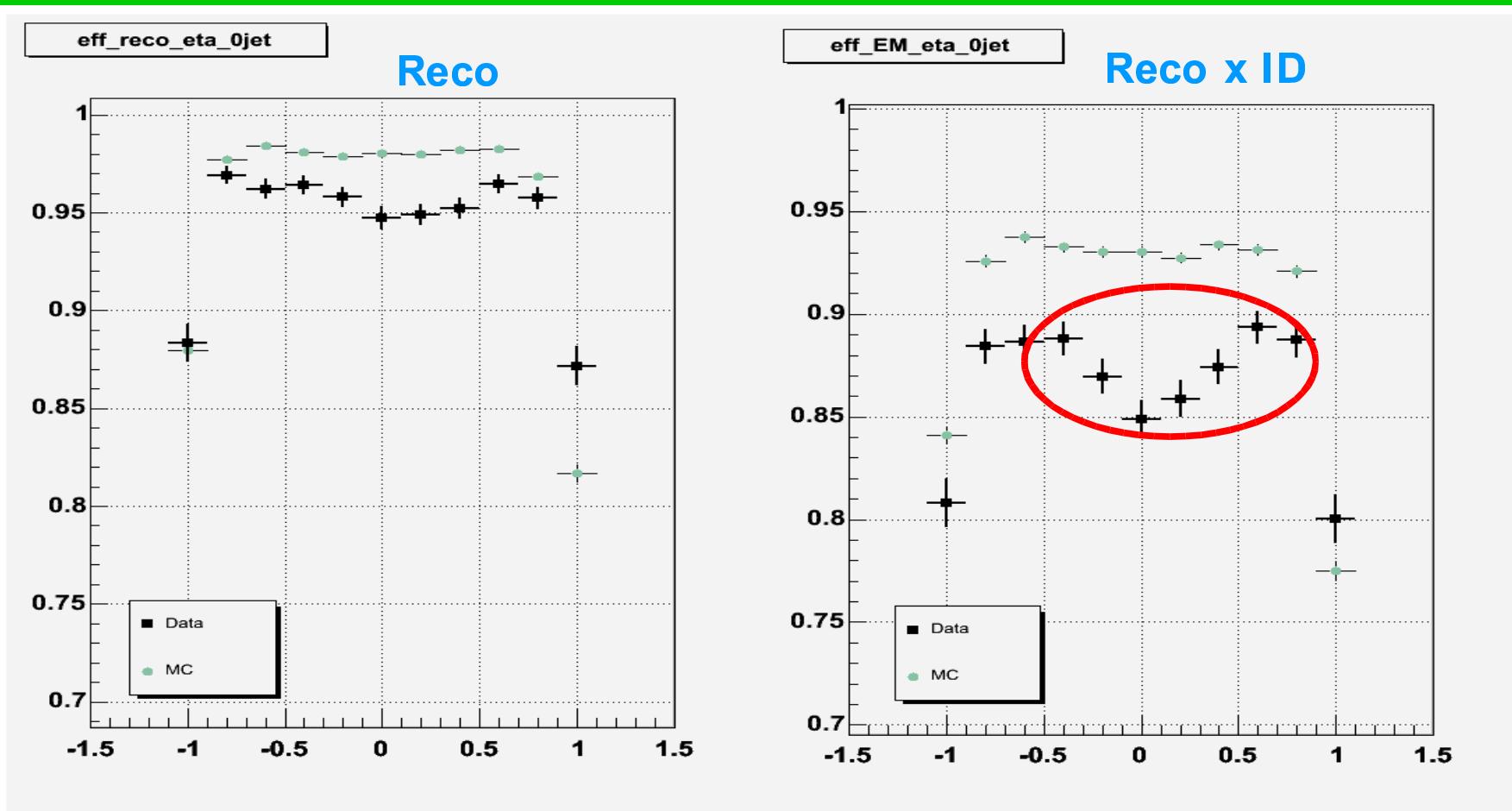
Some basic checks

- ✗ Electron pt vs electron eta
- ✗ Module 17
- ✗ Phi cracks
- ✗ Electron pT cut
- ✗ Mass window cut
- ✗ Jet Multiplicities
- ✗ Track matching
- ✗ Runrange dependence

See plots at the end of this talk ...



EM- and Reco efficiencies vs Eta

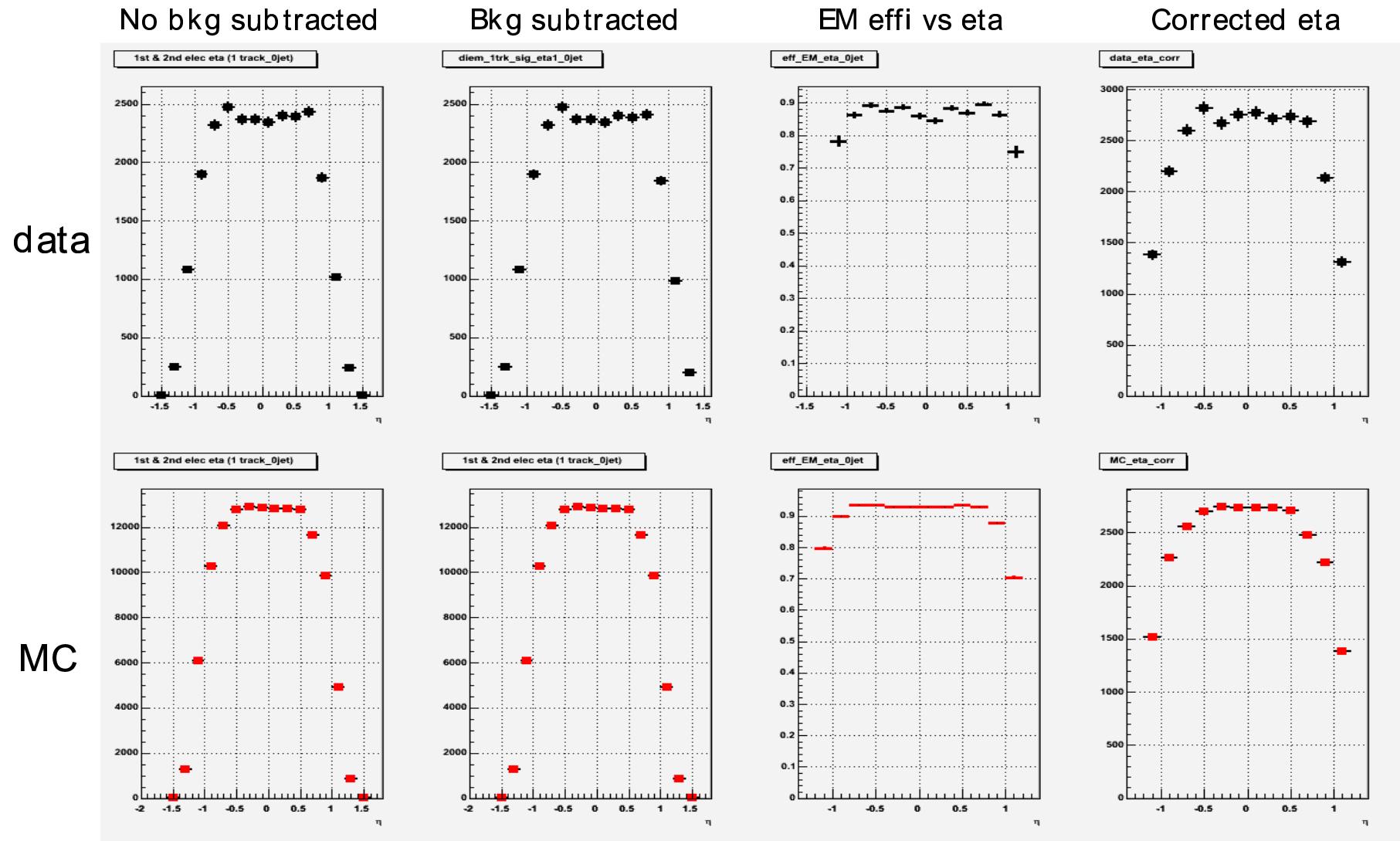


Applying opposite sign requirement and MET cut
No SB bkg subtraction applied

Averaged Effi w/o SB subtr = (86.6+-0.3)%
Averaged Effi with SB subtr = (87.2+-0.3)%



Correcting electron eta for EM inefficiencies



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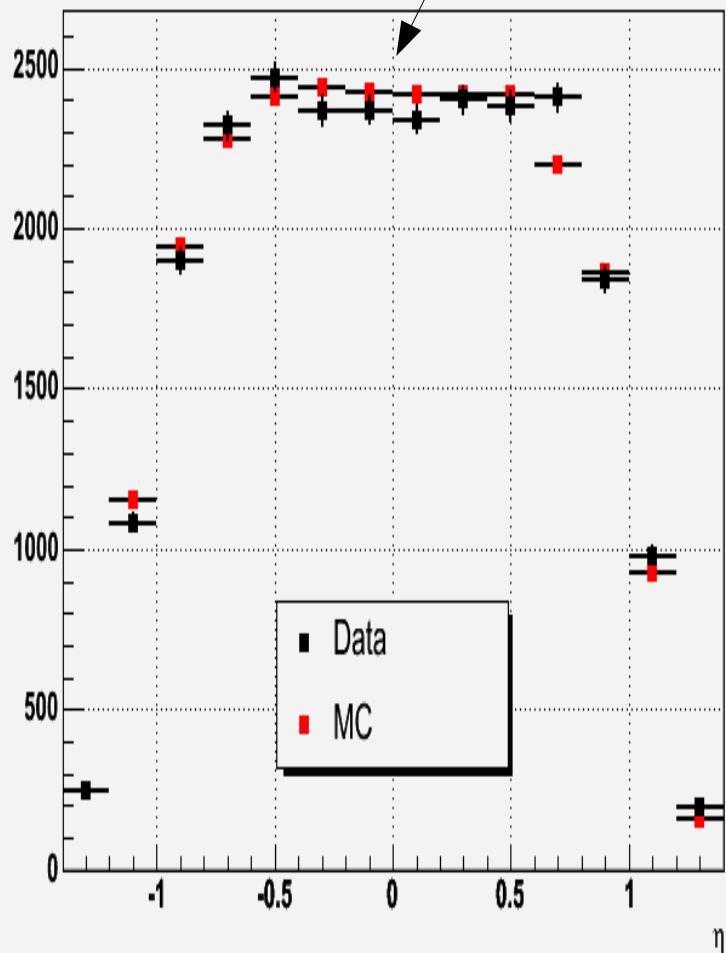
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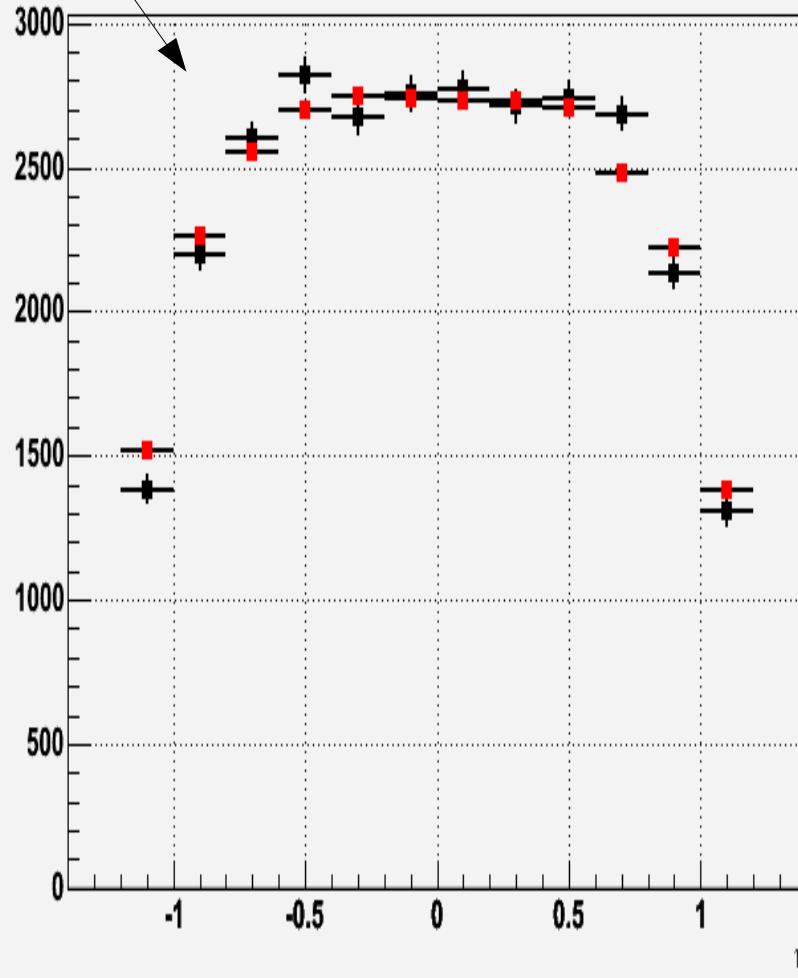
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Before and after correction

1st & 2nd elec eta (1 track_0jet)



data_eta_corr

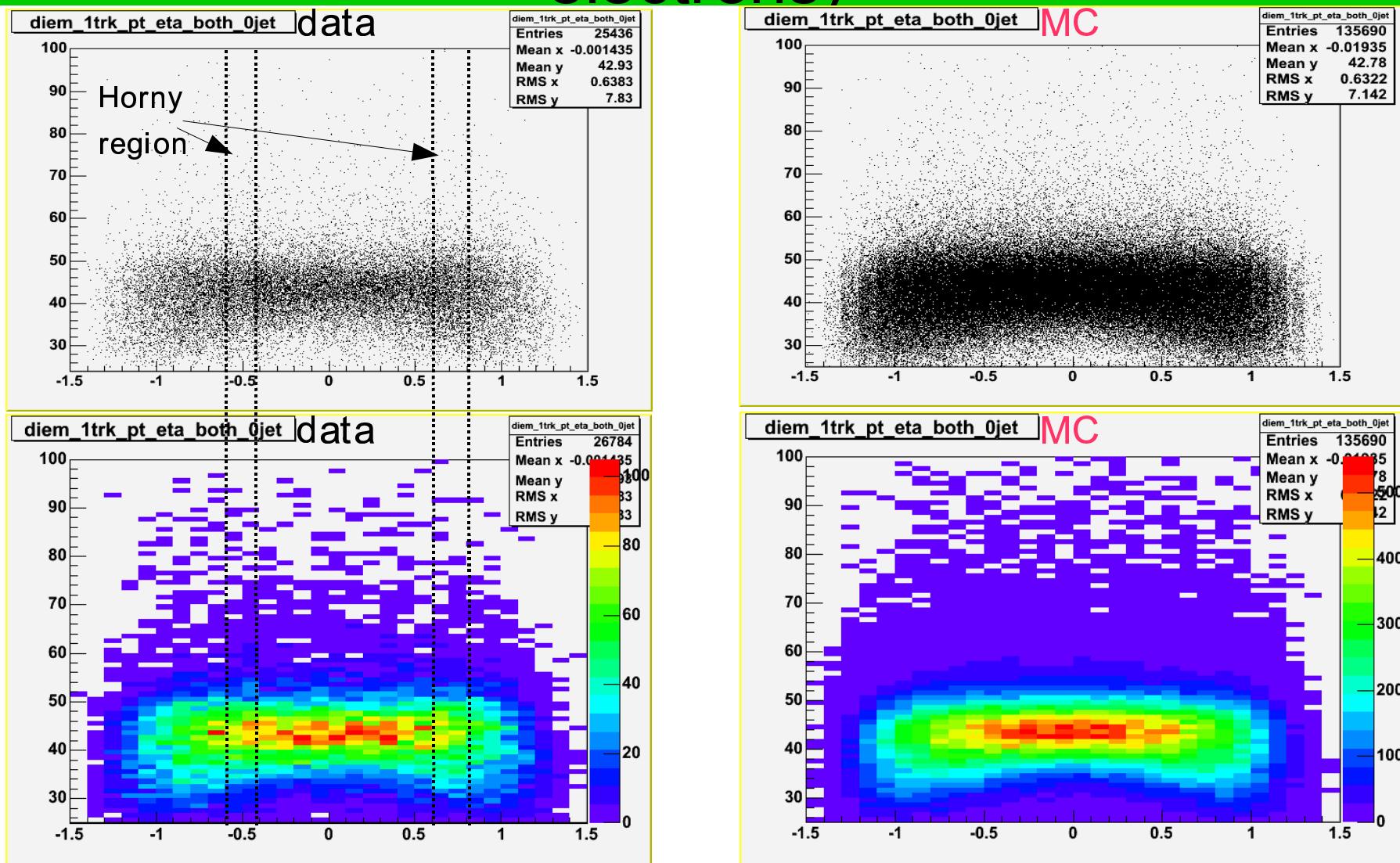


Todo

- Data vs MC:
 - Investigate eta spike
 - Correct pT
 - Correct for difference in Z pT between data and MC
 - Jets
- Acceptance:
 - Vs jet multiplicity
 - Correct for lost jets
- Smeared xsection

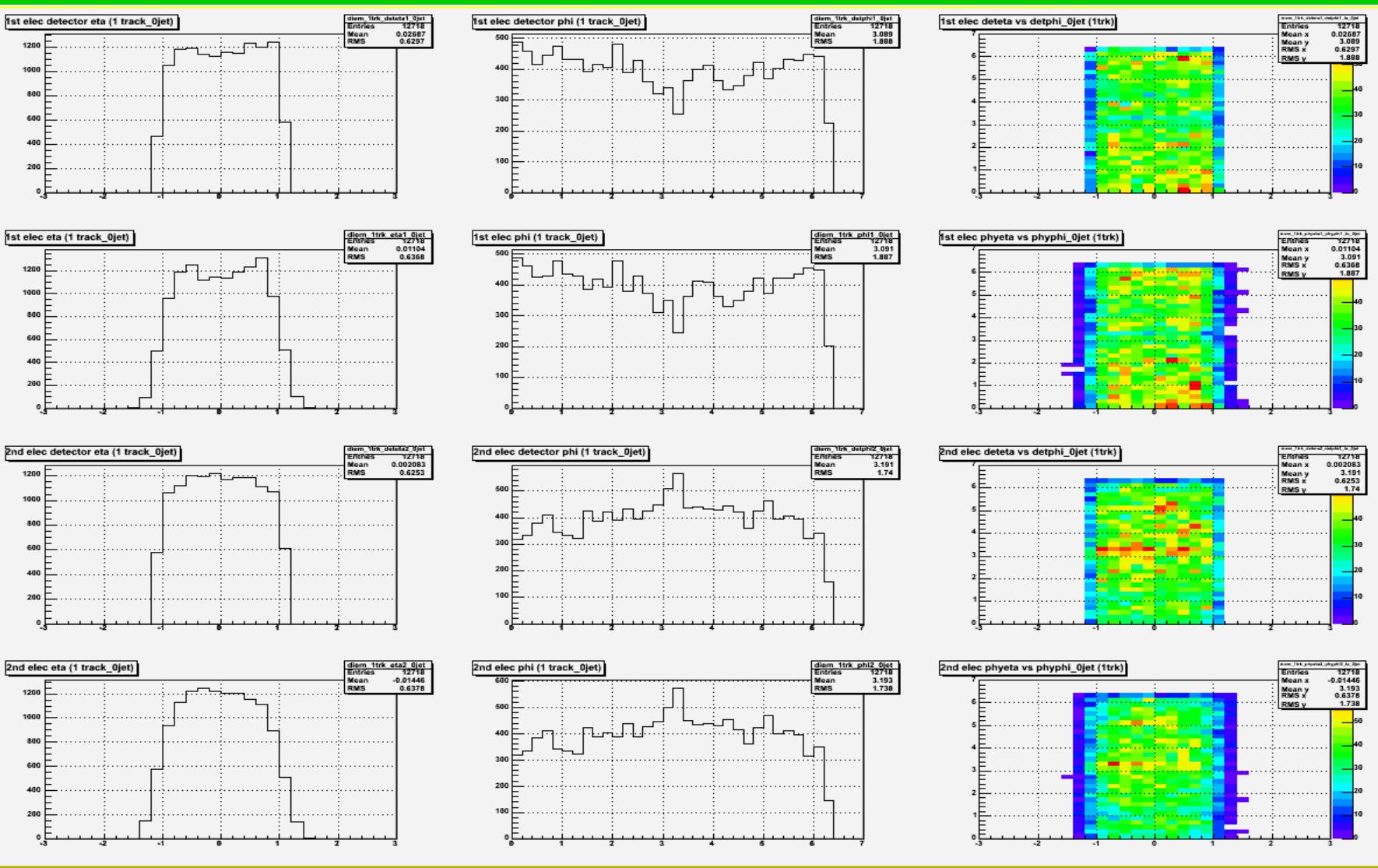


Electron pT vs Electron Eta (combining both electrons)



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Applying Analysis Cuts



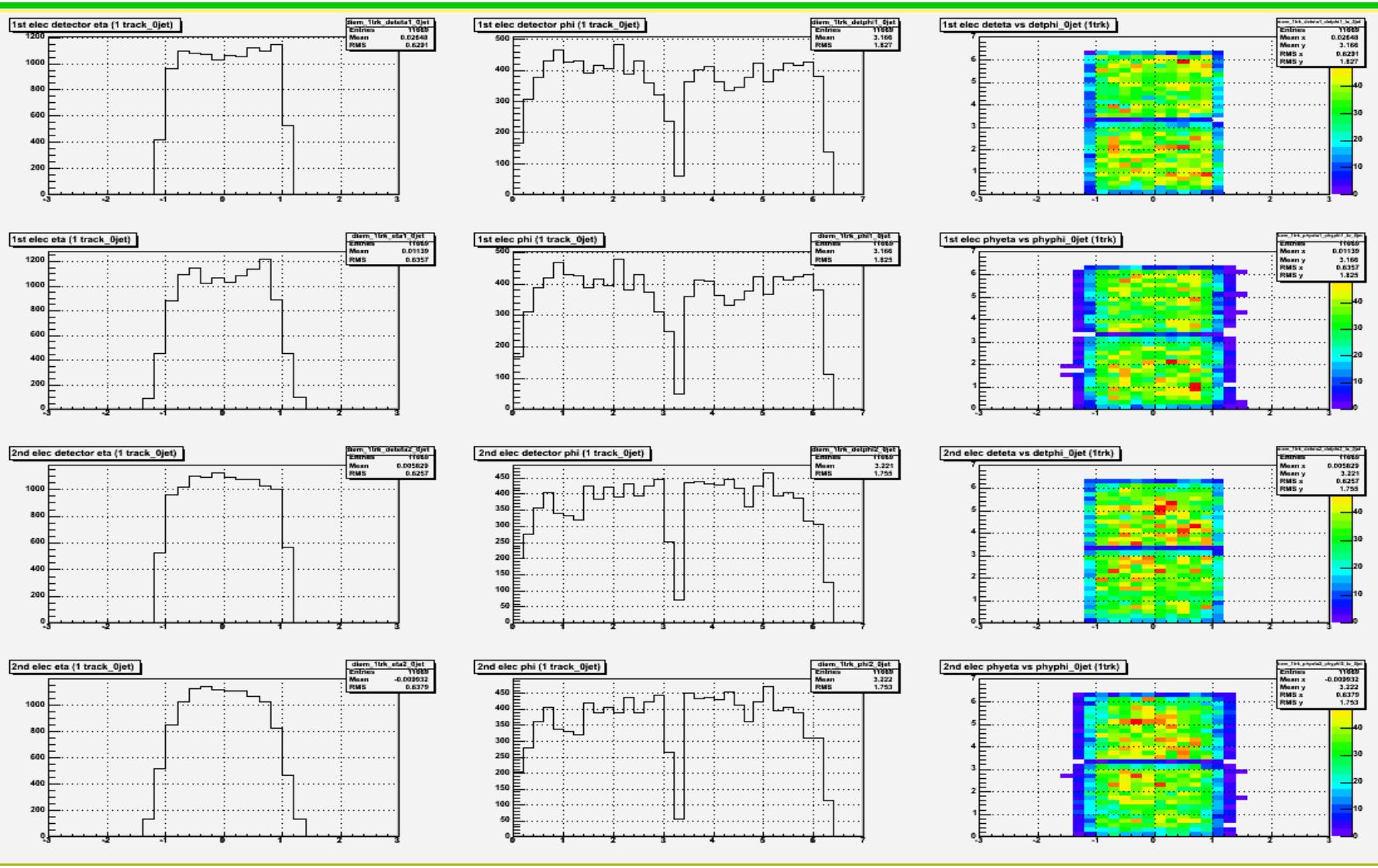
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Excluding CAL Module 17



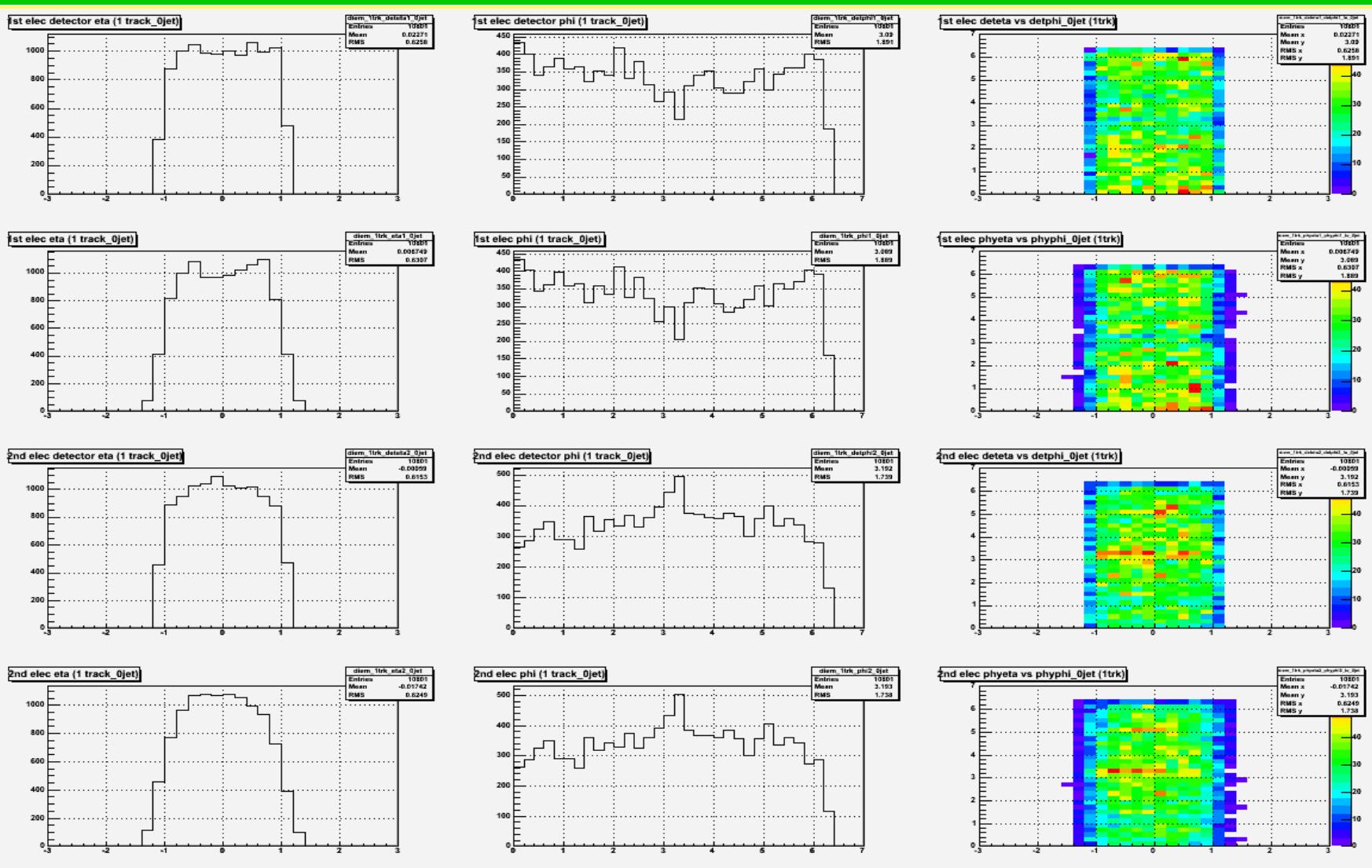
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Excluding Phi Cracks



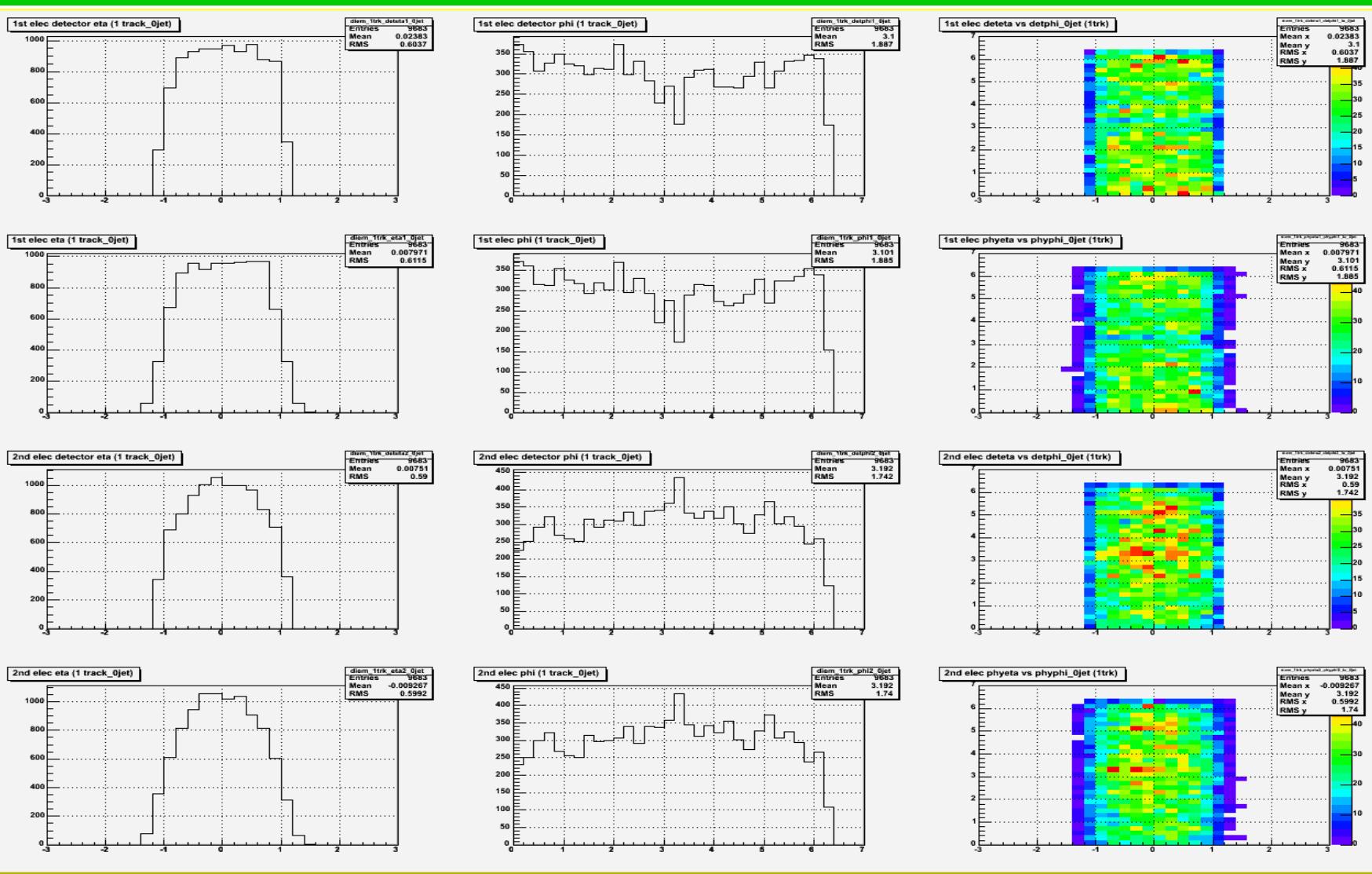
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Raising Electron pT Threshold: pT>35GeV



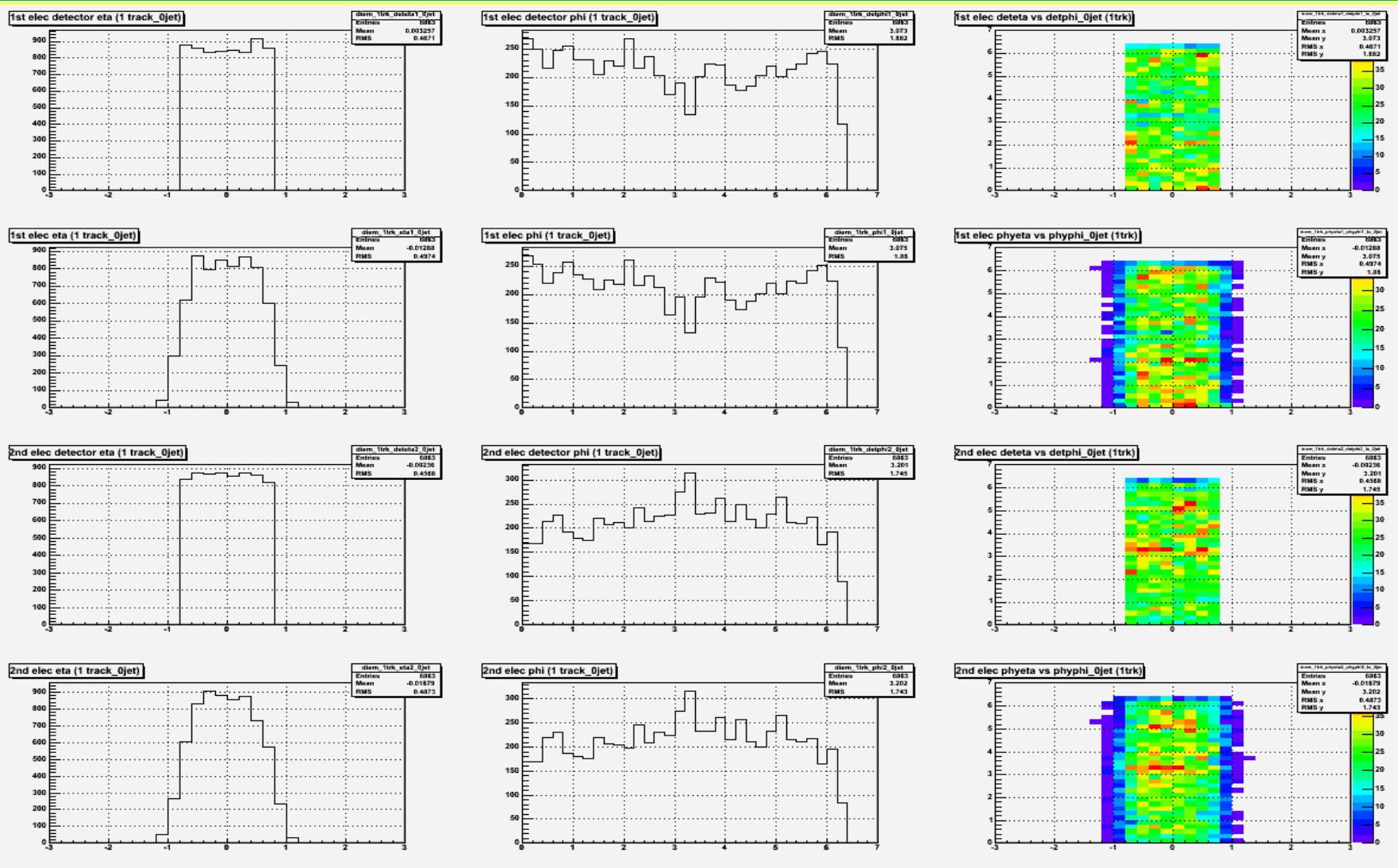
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Requiring $|\eta| < 0.8$



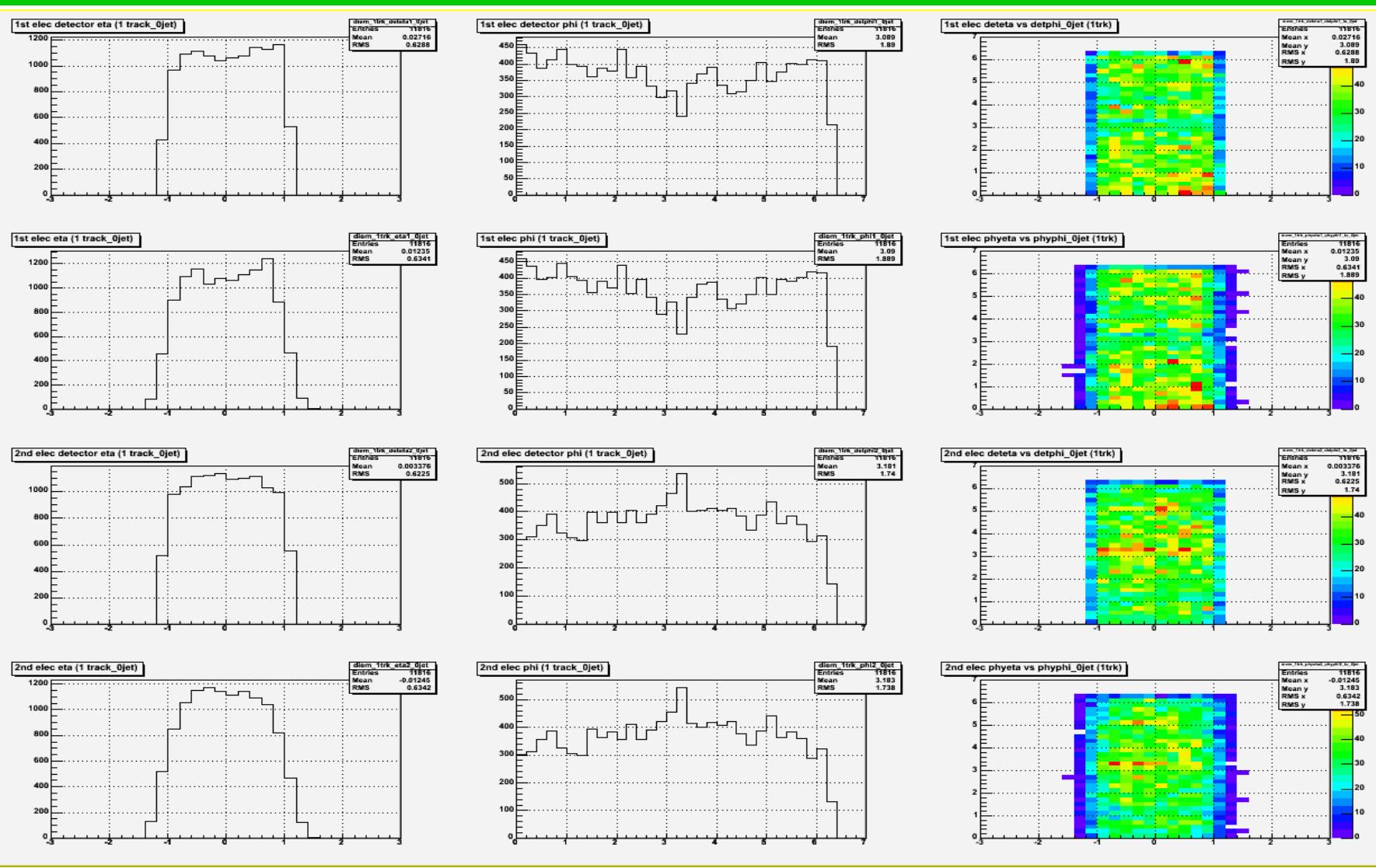
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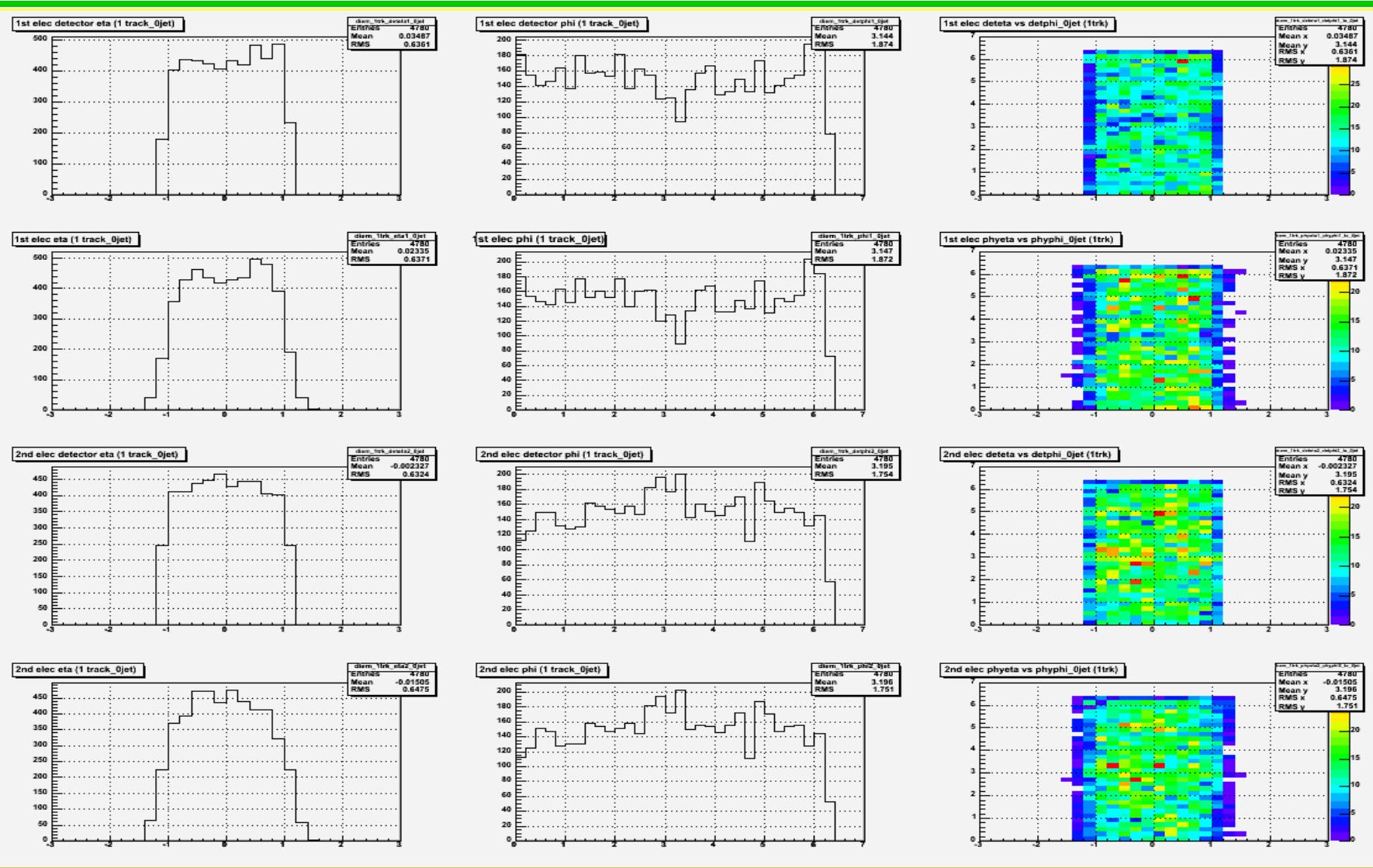
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Tightening Mass Window: $80\text{GeV} < M_{ee} < 100\text{GeV}$



Requiring 1 Track Match (exclusively)



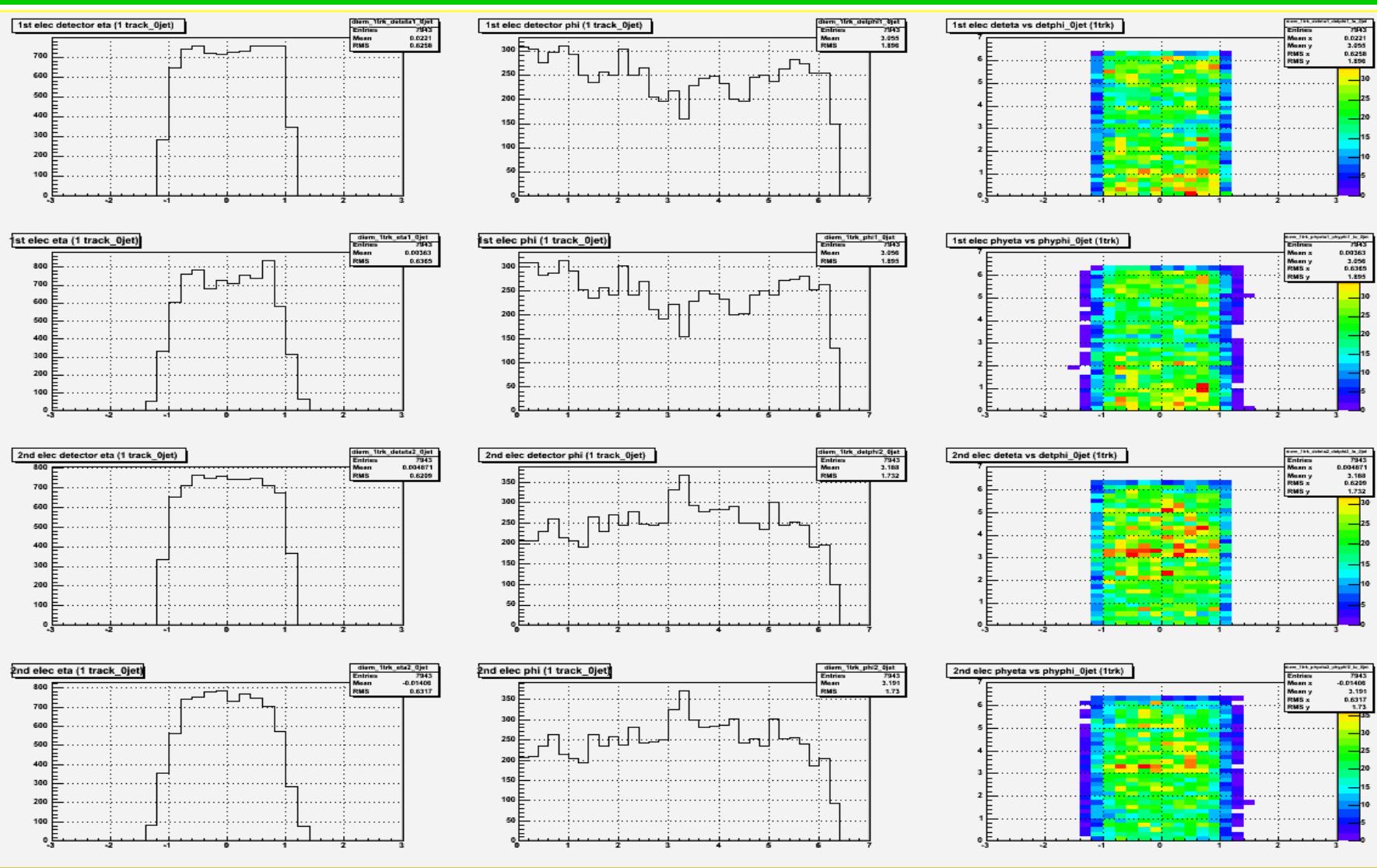
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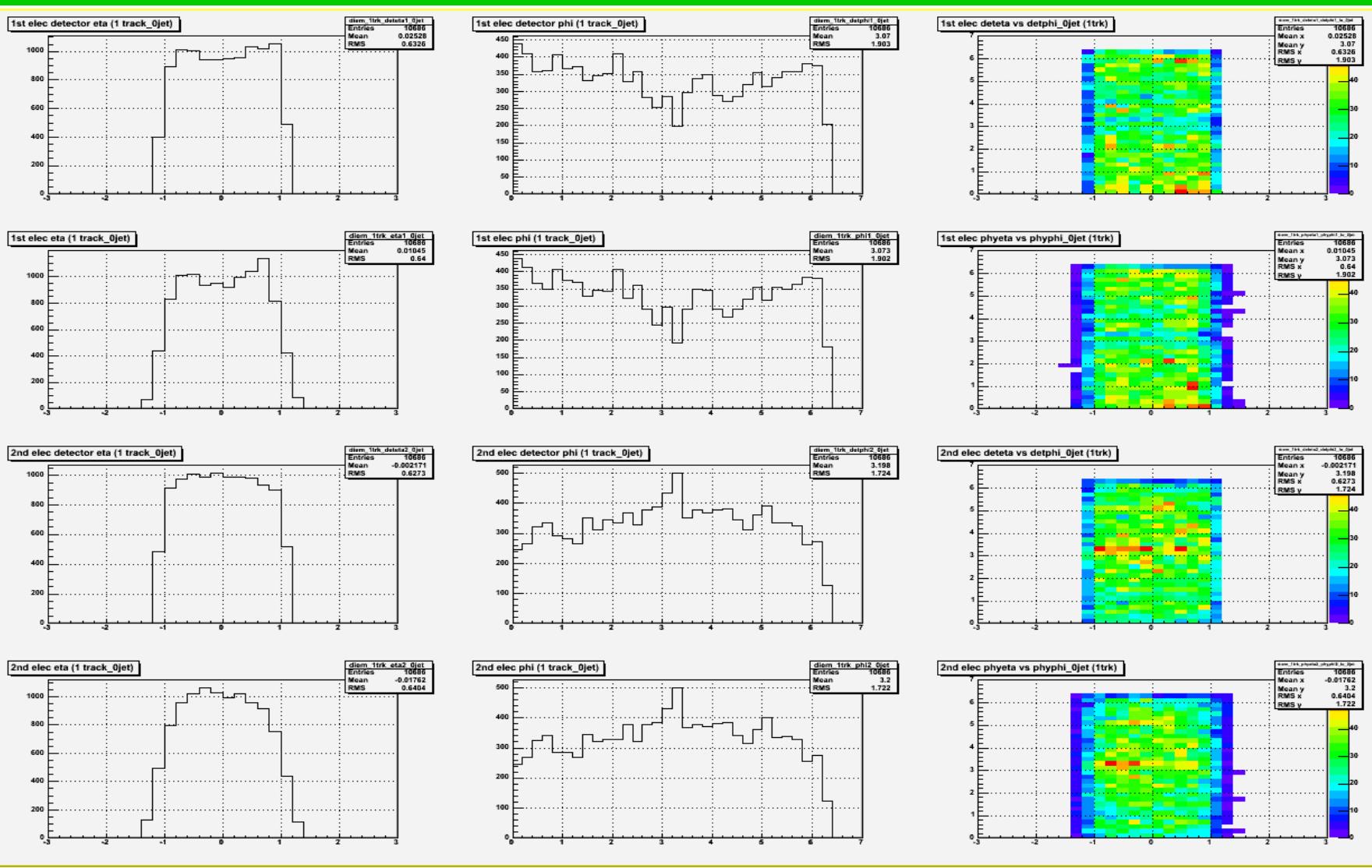
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Requiring 2 Track Matches (exclusively)



Number of Jets = 0 (Exclusively)



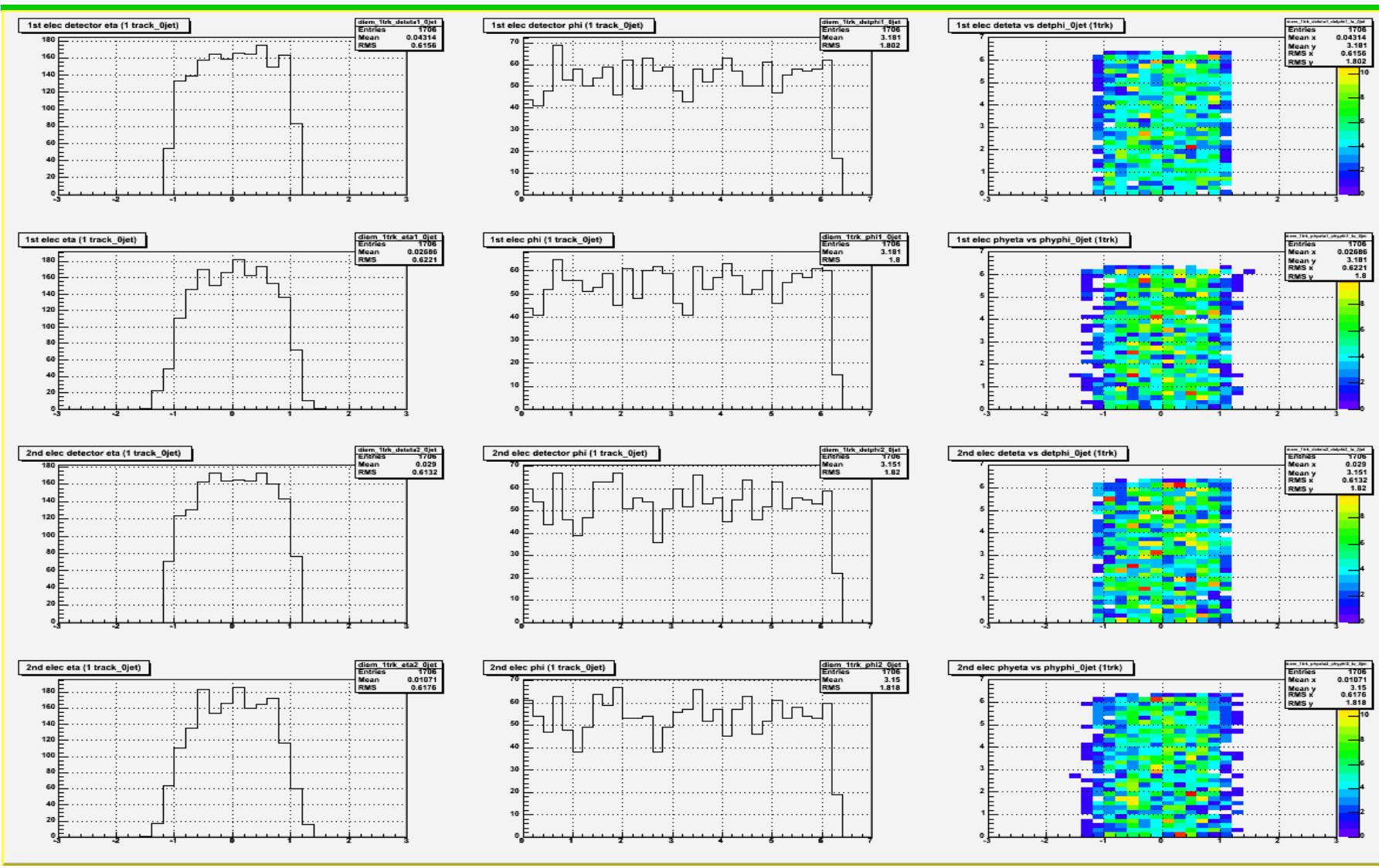
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Number of Jets = 1 (Exclusively)



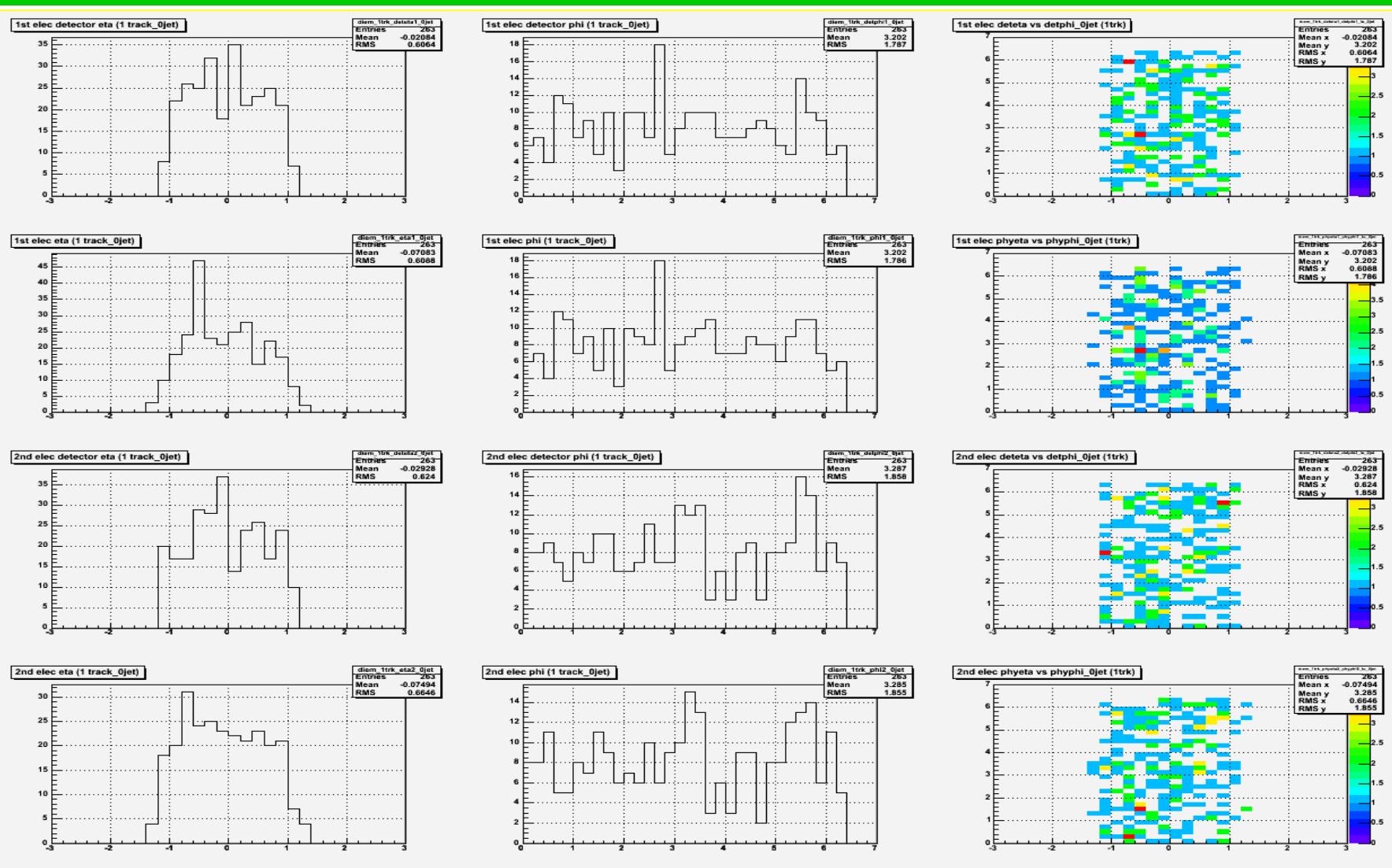
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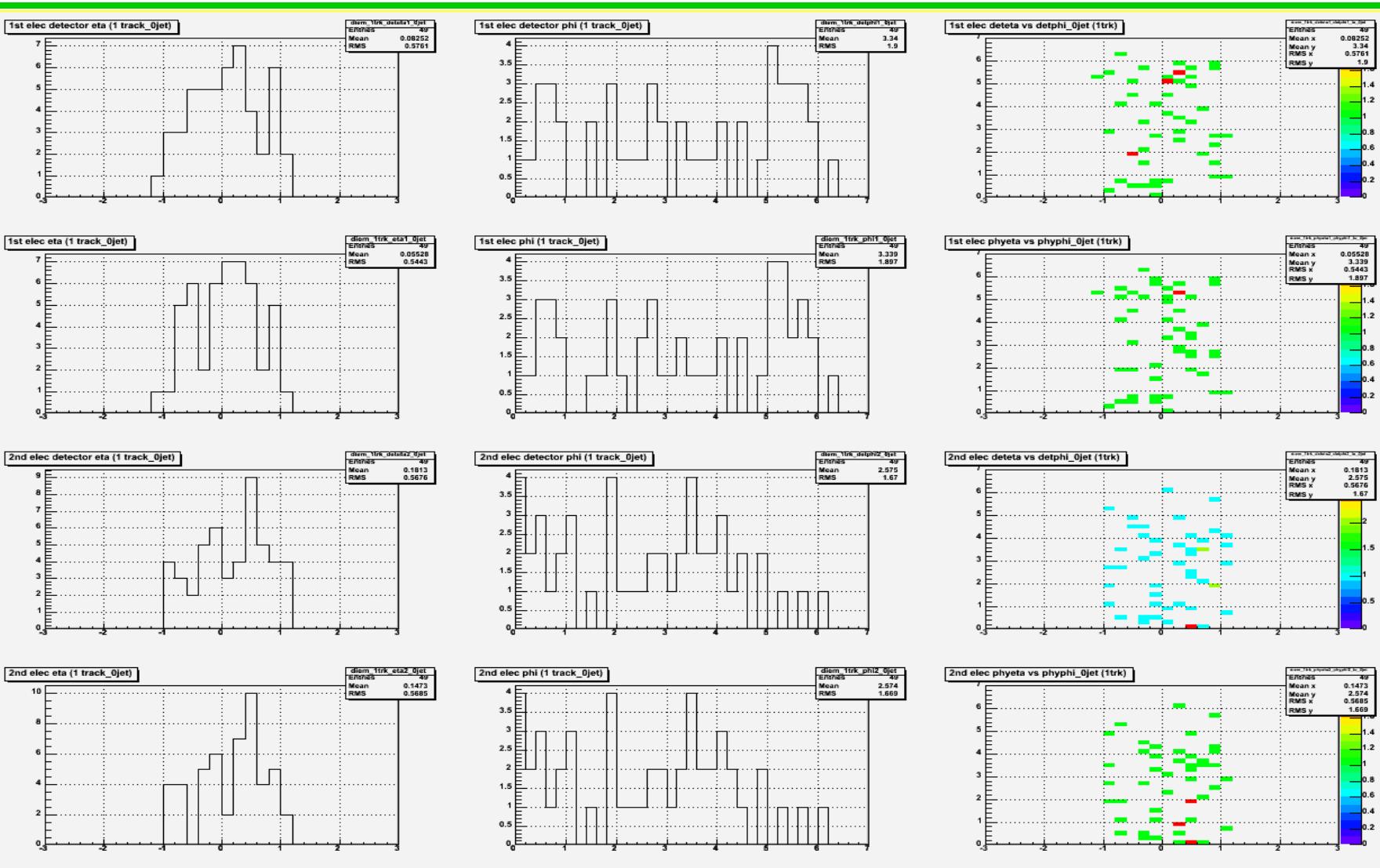
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Number of Jets = 2 (Exclusively)



Number of Jets = 3 (Exclusively)



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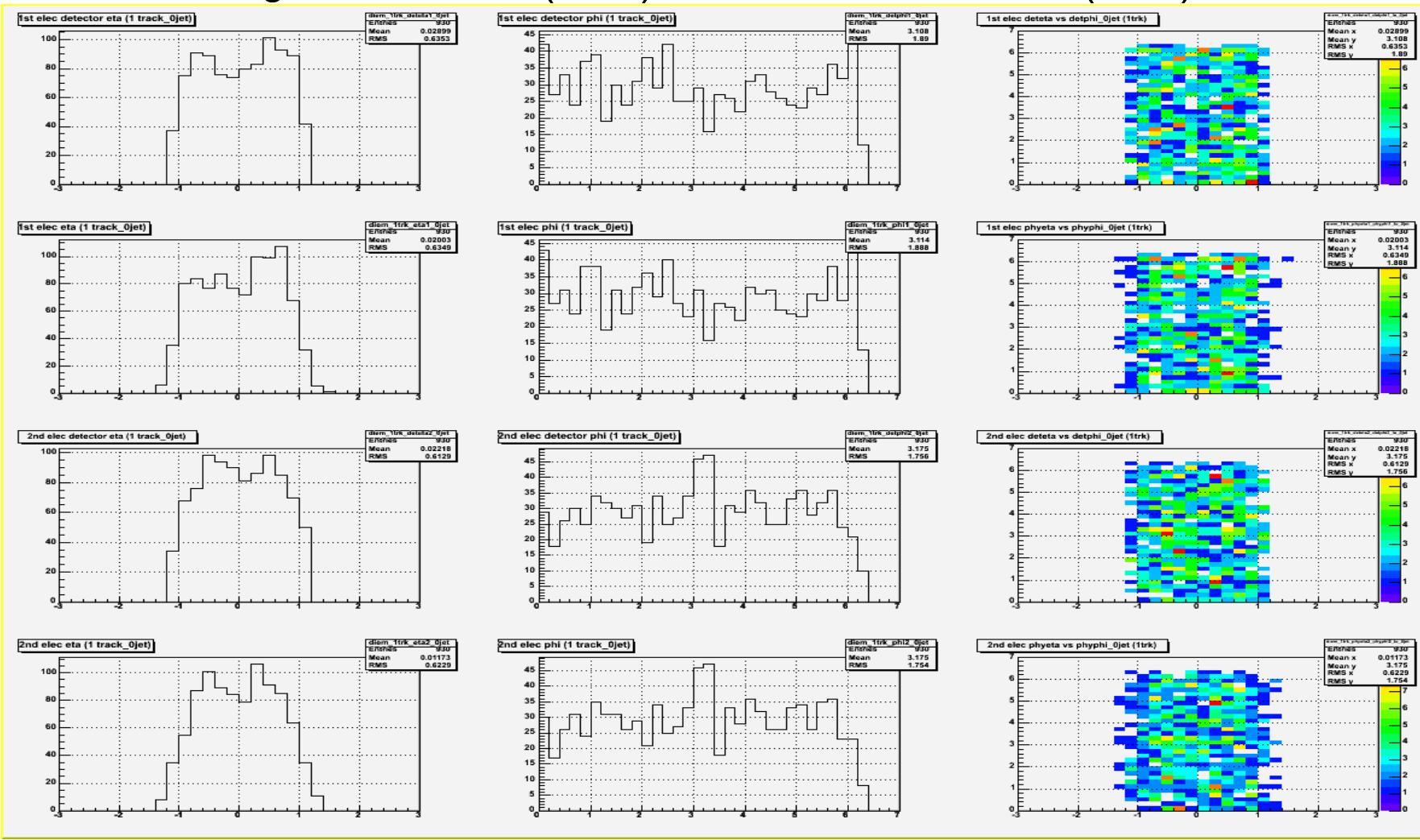
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Run Range: 161,973 - 168,134

August 15, 2002 (8.10) – November 15, 2002 (9.30)



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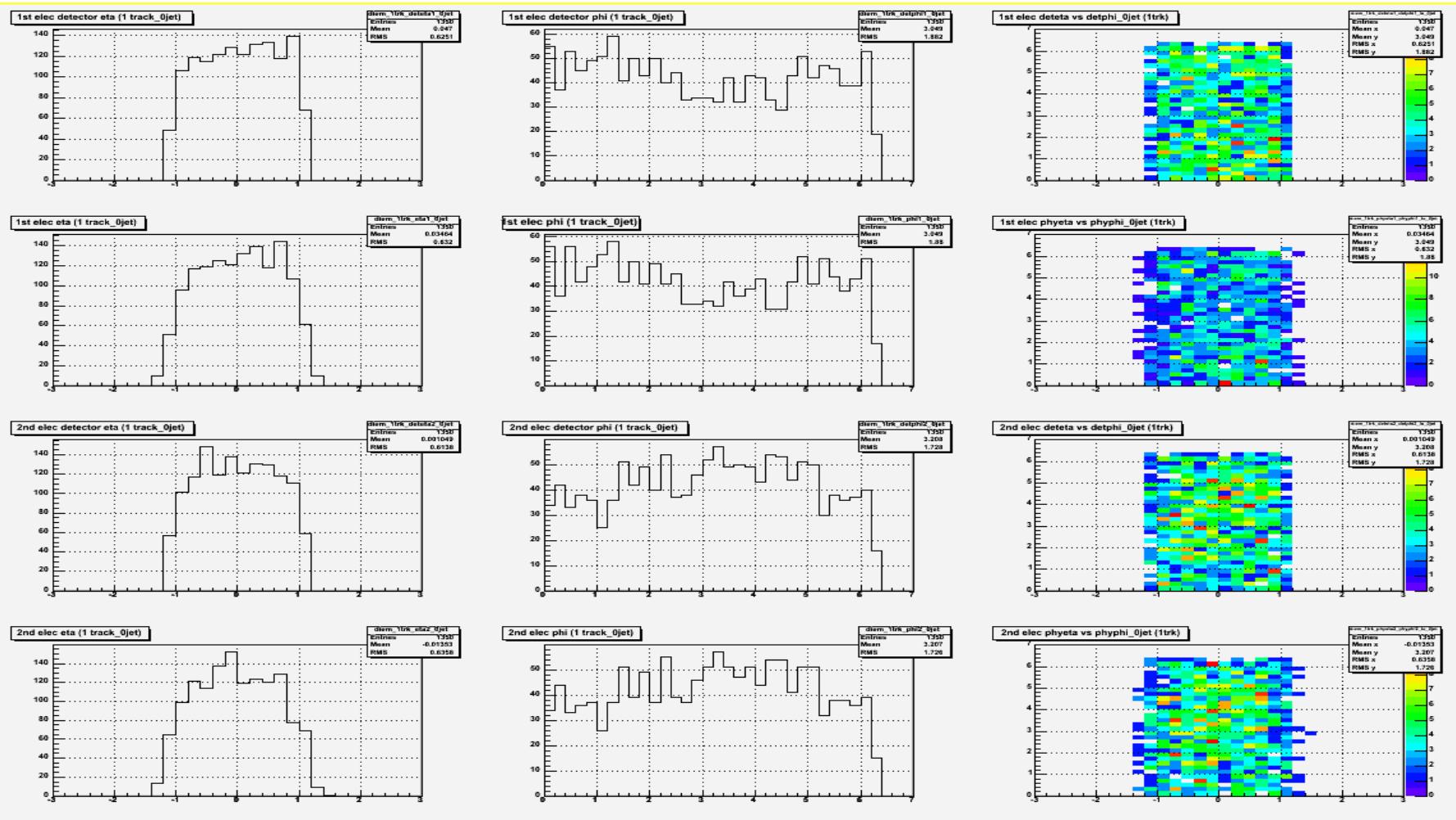
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Run Range: 168,135-174,495

November 15, 2002 (9.30) – March 20, 2003 (10.35)



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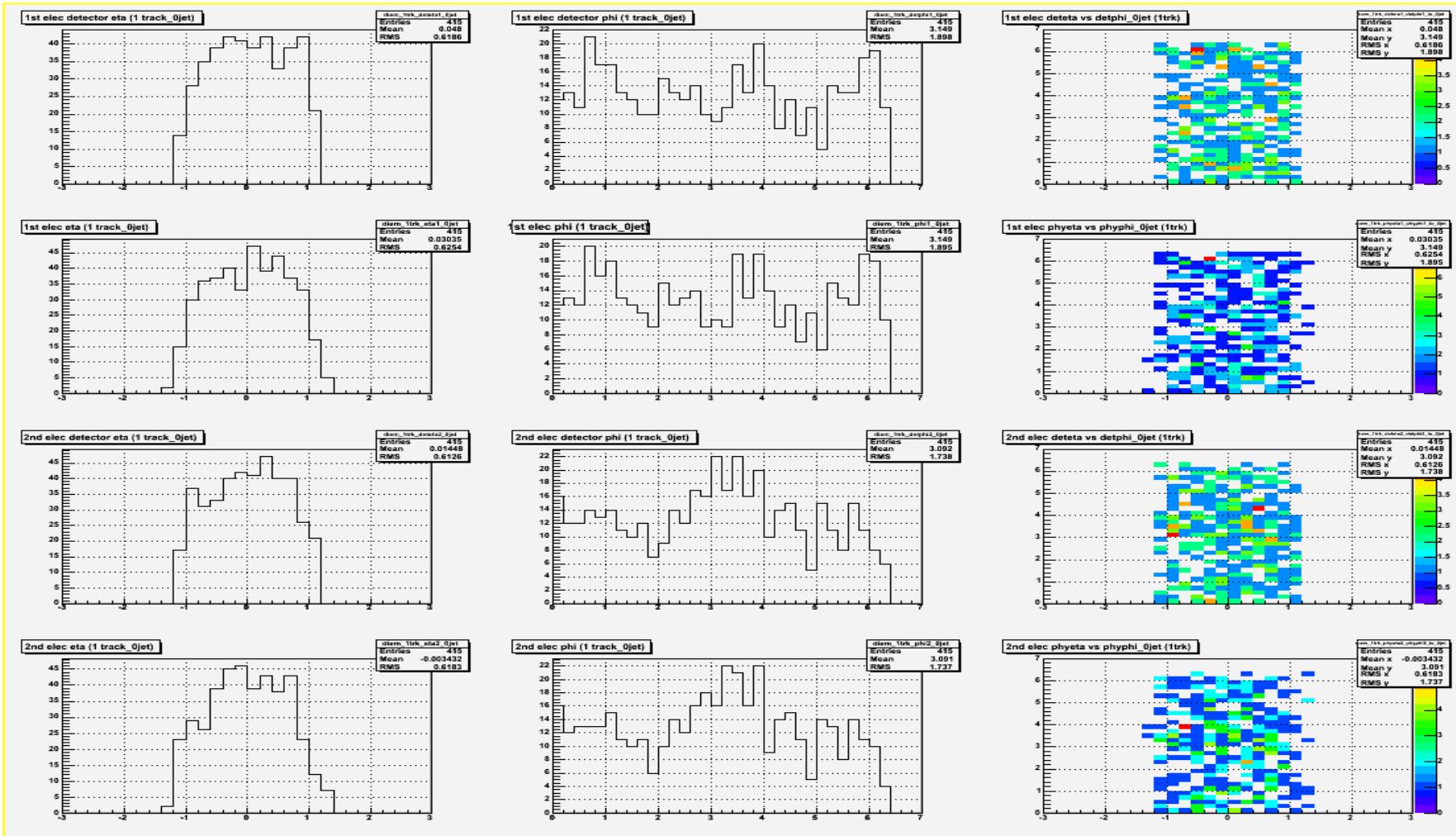
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Run Range: 174,496-175,819

March 20, 2003 (10.35) - April 17, 2003 (11.03)



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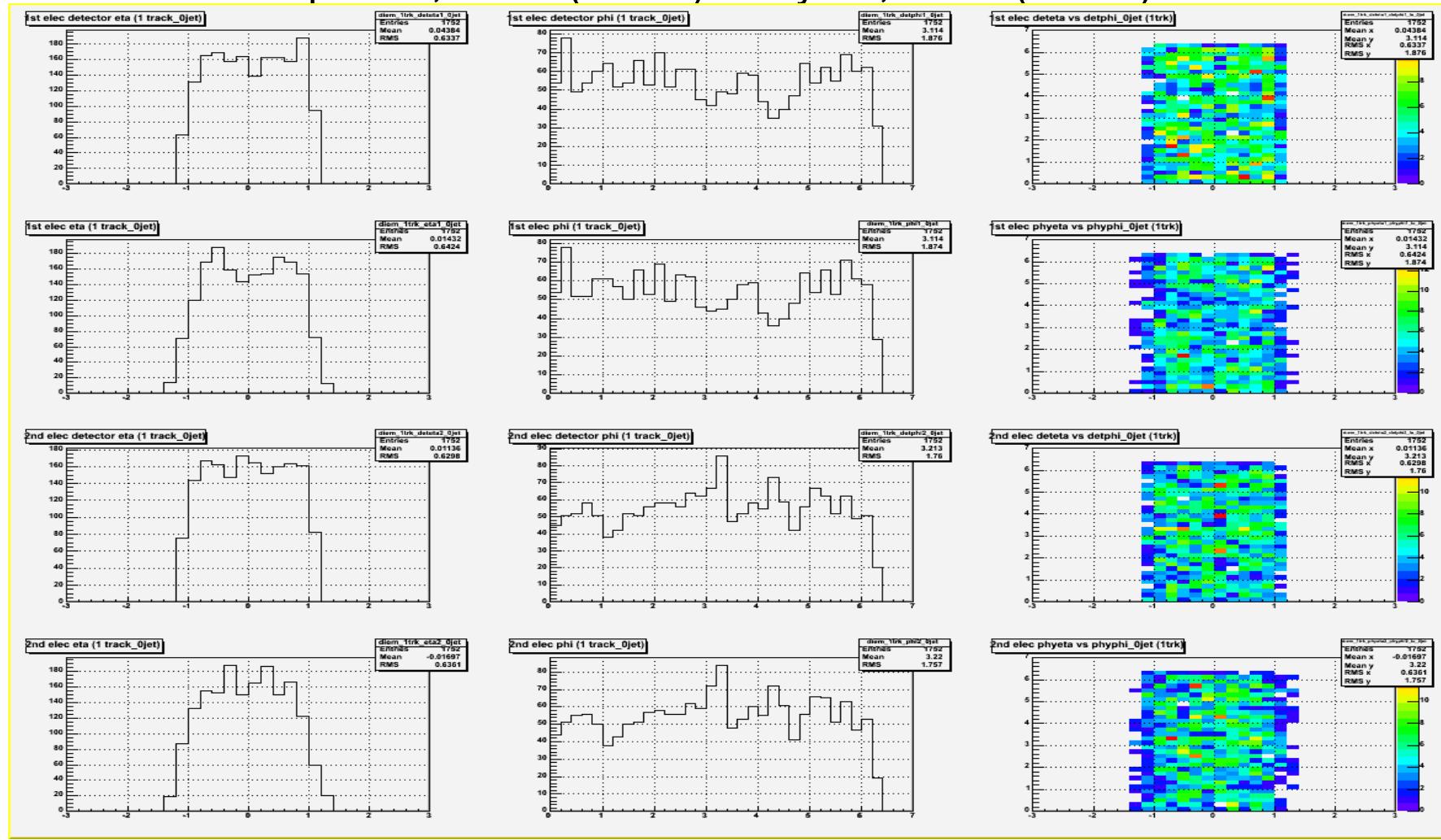
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Run Range: 175,820-178,788

April 17, 2003 (11.03) – July 10, 2003 (12.10)



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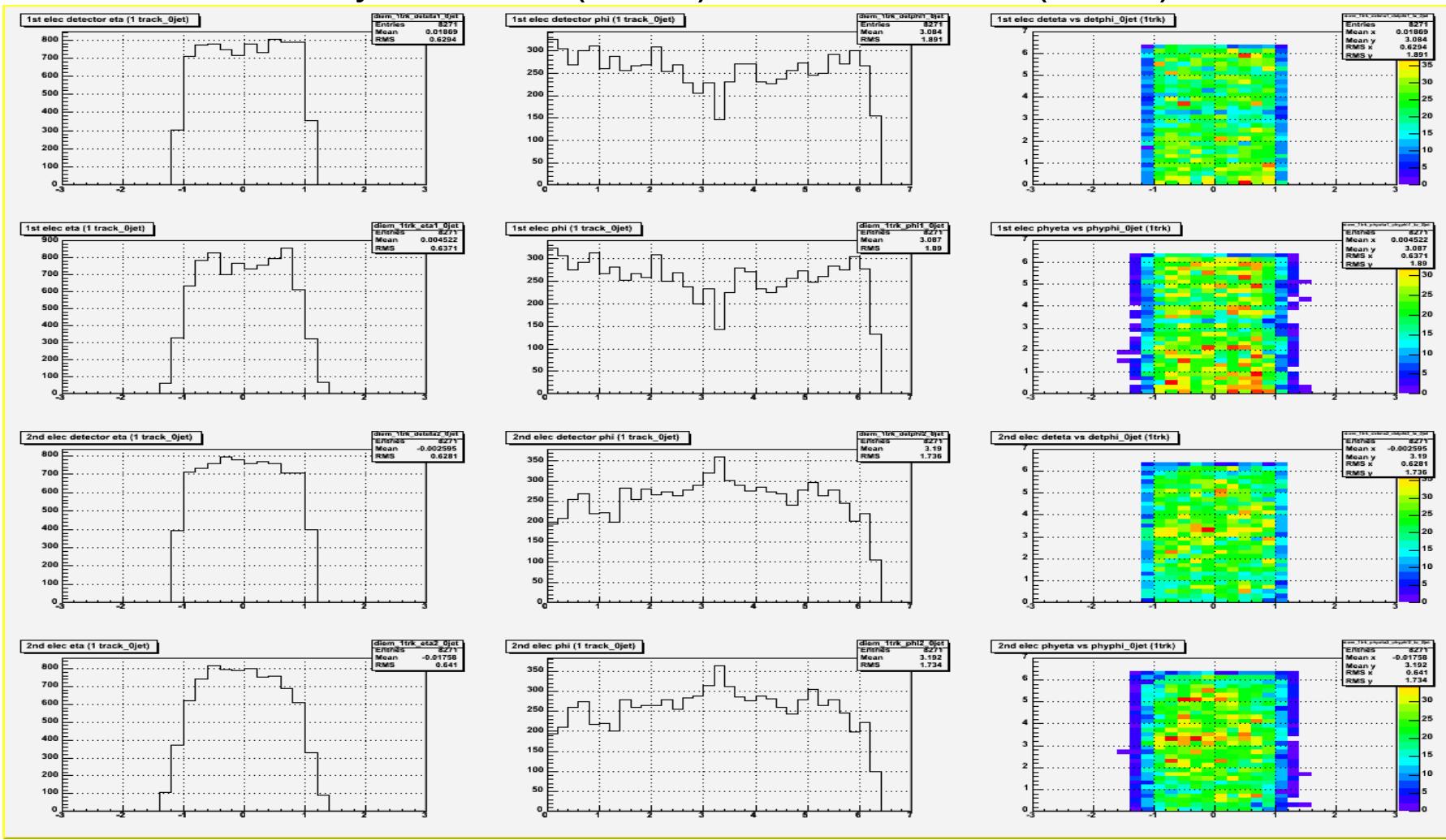
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Run Range: 178,789-194,566

July 10, 2003 (12.10) – June 29, 2004 (12.37)



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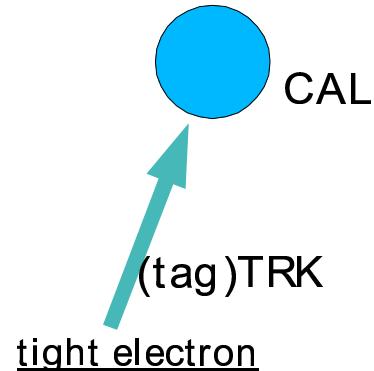
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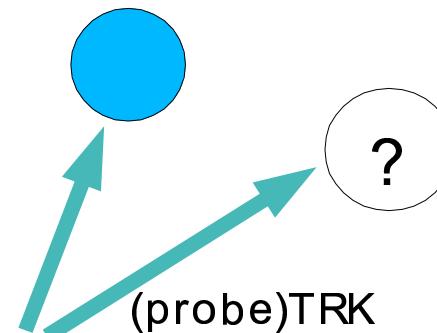
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Tag & Probe Method Overview

Tag:



Probe:



Z(ee) + n Jets Analysis Cuts:

PVX < 60cm

Tag-Electron: EMF > 0.9, Iso < 0.15, H_Mx7 < 12., p_T > 25 GeV, |η| < 1.1, **with phi cracks,**
matched with a good track in ΔR(<0.14)

Trigger: tag electron is required to have fired single electron trigger

Tag & ProbeTracks: 25 GeV < p_T < 80 GeV, Chi2 < 8.0, |DCA0| < 0.3, |DCA1| < 4.0, |η| < 1.1, **with phi cracks**

Probe: Good track separated from Tag by ΔΦ > 2.0

Background reduction: Opposite signed tracks, MET < 15 GeV

TagElec-ProbeTrack-inv mass cut: 70 GeV < M_{ee} < 110 GeV

Reco matching cone: dR = SQRT(Δη² + ΔΦ²) = SQRT(.1²+.1²) = 0.14

Jets: 0.05 < EMF < 0.95, HotF < 10.0, N90 > 1, CHF < 0.4, L1conf, p_T > 20., |eta| < 2.5, not counting jets

overlapping with probe tracks within ΔR < 0.4



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H(Multileptons)

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